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ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/629,415	BURKEY, TODD R.	
	Examiner	Art Unit	
	YAIMA CAMPOS	2185	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 February 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5,7,9,10,13 and 16-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,7,9,10,13 and 16-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/26/2009*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. As per the instant Application having Application number 10/629,415, the examiner acknowledges the applicant's submission of the amendment dated 2/12/2010. At this point, claims 4, 10, 13, 16 and 17-18 have been amended, and claims 6, 8, 11-12, 14-15 have been cancelled. Claims 1-5, 7, 9-10, 13 and 16-24 are pending.

REJECTIONS NOT BASED ON PRIOR ART

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 4 and 16 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

4. Applicant's Specification does not appear to provide support for the newly amended limitations of "after making the virtual disks available for operation, manipulating…" (claim 4) and "before the step of manipulating RAIDs, resizing... providing..." (claim 16). Applicant relies on paragraph 0049 to show support for this limitation; however, paragraph 0049 of Applicant's Specification recites "the process is reversed for dynamically shrinking mirrored virtual disks in a RAID storage system, with the exception that when downsizing, you may need to shrink

beyond the granularity that you expanded by... to shrink... you would need to first reduce the size of the VDisk and its mirrors, then remove the 50 MB raid in both the source and destination, and finally truncate the two 100 MB raids into 75 MB raids"; without providing any explanation as to when the virtual disks are made available for operation or that the manipulating occurs after making the virtual disks available for operation.

REJECTIONS BASED ON PRIOR ART

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. **Claim 1-2, 9 and 19-24** are rejected under 35 U.S.C. 103(a) as being unpatentable over Lubbers et al. (US 6,880,052) in view of Bridge (US 6,530,035).

7. As per **claim 1**, Lubbers discloses A program storage device readable by a computer embodying in a tangible medium one or more programs of instructions executable by the computer to perform a method for dynamically expanding mirrored virtual disks in a virtual disk storage system, the method comprising: **[increasing the size of virtual disks or logical units (LUNs) in an automated fashion in a copy set or replication environment having source and destination LUNs wherein each LUN has a RAID 0-5 data protection (col. 4, lines 44-67; col. 5, lines 59-62)]**

receiving by a source virtual disk a request to dynamically expand the mirrored virtual disks

which include the source virtual disk and at least one destination virtual disk; **[host provides capacity requirements to storage controllers 105 and source LUNs are configured for host access wherein LUNs may be resized according to host requirement (col. 5, line 27-col. 6, line 5) the size of LUNs can be increased/resized in an automated fashion wherein the increase is automatically propagated to other members of a copy set (col. 4, lines 44-67)]** associating additional storage with the mirrored virtual disks; **[size of LUNs increased by allocating more storage from physical devices (col. 5, line 51-col. 6, line 37; col. 8, lines 5-9)]** increasing respective sizes of each of the at least one destination virtual disk **[Lubbers discloses "a copy set" is a set of member virtual disks where each member virtual disk is a replica of the others" (col. 8, line 57-col. 9, line 8) wherein a LUN may be resized and the resizing is automatically propagated to other members of the copy set (col. 4, lines 44-67; col. 6, lines 5-37)]** but does not expressly disclose these changes are implemented before reporting a new storage size of the source virtual disk; and reporting the new size of the source virtual disk

To further detail Lubbers, Bridge discloses receiving a request to resize a virtual disk, associating additional storage with the virtual disk and reporting the new sizes users and more specifically, resizing or changes the size of a logical unit are implemented before reporting a new storage size of the source virtual disk (or logical unit); and reporting the new size of the source virtual disk (or logical unit) **[expanding or shrinking logical volumes by adding or removing extents wherein when the logical volume is configured to a new size, the new size is reported in logical volume directory; thus allowing I/O operations are allowed on the logical volume (col. 16, line 32- col. 17, line 4; col. 20, lines 1-33) wherein the added or removed extents may be mirrored (col. 17, line 5-col. 18, line 58)]**.

Lubbers and Bridge are analogous art because they are from the same field of endeavor of computer memory access and control.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify the system of Lubbers which provides source and destination virtual disks in a copy set and resizes these virtual disks in an automatic fashion wherein any changes to a source virtual disk are propagated to the destination virtual disk and further explicitly expand the size or perform changes of size of the copy set of source and destination virtual disks of Lubbers and later reporting the size of the copy set or source and destination virtual disks in the same manner that Bridge first resizes a logical unit and later reports the changes to the logical unit by updating directory tables in order to allow I/O access to the virtual disks, since Bridge discloses this provides the advantage of dynamically accommodating to system requirement changes in a mirrored system configuration (col. 3, line 45-col. 4, line 59; fig. 9 and related text).

Therefore, it would have been obvious to combine Lubbers with Bride for the benefit of creating a system/method of resizing virtual disks to obtain the invention as specified in claim 1.

8. As per claim 2 The program storage device of claim 1 wherein the request step of associating additional storage further comprises: creating an amount of storage by providing RAIDs on each subsystem that is associated with each component of a mirror set; assigning the RAIDs to a specific virtual disk for a mirror device; and **[Lubbers discloses each LUN has a specified data protection RAID 0-5 level wherein the data protection level of source and destination may vary (col. 5, line 51-col. 6, line 5; col. 6, lines 16-37)]** specifying a size for the virtual disk and mapping the size of the virtual disk directly to all components of the mirror set **[Lubbers discloses the LUNs in a copy set are mirror and are**

mapped to physical disks and each LUN has a specified RAID 0-5 level (col. 5, line 51-col. 6, line 37)].

9. As per claim 9 . (previously presented) The apparatus of claim 23, wherein creating an amount of necessary storage includes providing RAIDs on each subsystem that is associated with each component of a mirror set, attaching the RAIDs to a specific virtual disk for a mirror device and specifying a size for the virtual disk and mapping the size of the virtual disk directly to all components of the mirror set **[The rationale in the rejection to claim 2 is herein incorporated]**.

10. As per claim 19 The program storage device of claim 1, wherein a first of the mirrored virtual disks has a different virtualization configuration from a second of the mirrored virtual disks **[Lubbers discloses source virtual disk and destination virtual disk may each implement different data protection configurations (col. 7, line 64-col. 8, line 29; col. 5, line 51-col. 6, line 37)]**.

11. As per claim 20 A method, comprising: receiving a request to dynamically resize mirrored virtual disks, the mirrored virtual disks comprising a source virtual disk and a set of destination virtual disks that includes at least one destination virtual disk; associating additional storage with the mirrored virtual disks; reporting respective new storage sizes of each destination virtual disk before reporting a new storage size of the source virtual disk; and reporting the new storage size of the source virtual disk **[The rationale in the rejection to claim 1 is herein incorporated]**.

12. As per claim 21. The method of claim 20, wherein the request is received by the source virtual disk **[Lubbers discloses host provides capacity requirements to storage controllers**

105 and source LUNs are configured for host access wherein LUNs may be resized according to host requirement (col. 5, line 27-col. 6, line 5) wherein host writes to source LUNs (figs. 4-6 and related text)].

13. As per claim 22 The method of claim 21, wherein, in the step of receiving, the request is received electronically from a host and, in the step of reporting the new storage size of the source virtual disk, the new storage size of the source virtual disk is reported to the host **[Lubbers discloses the size of source virtual disk becomes available for host writes, thus it is reported to host (col. 5, line 26- col. 6, line 5; col. 12, lines 38-51)]**. Bridge discloses **[expanding or shrinking logical volumes by adding or removing extents wherein when the logical volume is configured to a new size, the new size is reported in logical volume directory; thus allowing I/O operations are allowed on the logical volume (col. 16, line 32- col. 17, line 4; col. 20, lines 1-33) wherein the added or removed extents may be mirrored (col. 17, line 5-col. 18, line 58)]**.

14. As per claim 23, Lubbers discloses An apparatus, comprising:

a set of mirrored virtual disks, including a source virtual disk and at least one destination virtual disk, the at least one destination virtual disk mirroring the source virtual disk, wherein the source and destination virtual disks have the same size; **[source and destination virtual disks (fig. 4 and related text; col. 7, line 64-col. 8, line 29)]**

a management module that includes a host side interface adapted to [*interpreted as intended use, See MPEP 2106 II-C*] communicating with host devices, through which the management module is adapted by logic to [*interpreted as intended use, See MPEP 2106 II-C*] report the size of the mirrored virtual disks and to receive a request to expand the mirrored virtual disks, and

a storage system interface for [*interpreted as intended use, See MPEP 2106 II-C*] communicating with the virtual disks that is adapted to [*interpreted as intended use, See MPEP 2106 II-C*] requesting the source virtual disk to expand and to [*interpreted as intended use, See MPEP 2106 II-C*] obtain reports of the size of the virtual disks from the source virtual disk; and logic adapted to [*interpreted as intended use, See MPEP 2106 II-C*] provide reports of the size of the source virtual disk to the management module through the storage system interface, **[capacity requirements to storage controllers 105 and source LUNs are configured for host access wherein LUNs may be resized according to host capacity requirements (col. 5, line 27-col. 6, line 5; col. 4, lines 44-67) the size/capacity of source virtual disk is available for host accesses and is thus reported (col. 7, line 64-col. 8, line 29)]**
satisfy an expansion request by creating an amount of necessary storage before changing the size that will be obtained by the management module in reports from the source virtual disk; and change the size that will be obtained by the management module in reports from the source virtual but does not disclose expressly these changes are implemented before reporting a new storage size of the source virtual disk; and reporting the new size of the source virtual disk

To further detail Lubbers, Bridge discloses receiving a request to resize a virtual disk, associating additional storage with the virtual disk and reporting the new sizes users and more specifically, resizing or changes the size of a logical unit are implemented before reporting a new storage size of the source virtual disk (or logical unit); and reporting the new size of the source virtual disk (or logical unit) **[expanding or shrinking logical volumes by adding or removing extents wherein when the logical volume is configured to a new size, the new size is reported in logical volume directory; thus allowing I/O operations are allowed on the**

logical volume (col. 16, line 32- col. 17, line 4; col. 20, lines 1-33) wherein the added or removed extents may be mirrored (col. 17, line 5-col. 18, line 58)].

Lubbers and Bridge are analogous art because they are from the same field of endeavor of computer memory access and control.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify the system of Lubbers which provides source and destination virtual disks in a copy set and resizes these virtual disks in an automatic fashion wherein any changes to a source virtual disk are propagated to the destination virtual disk and further explicitly expand the size or perform changes of size of the copy set of source and destination virtual disks of Lubbers and later reporting the size of the copy set or source and destination virtual disks in the same manner that Bridge first resizes a logical unit and later reports the changes to the logical unit by updating directory tables in order to allow I/O access to the virtual disks, since Bridge discloses this provides the advantage of dynamically accommodating to system requirement changes in a mirrored system configuration (col. 3, line 45-col. 4, line 59; fig. 9 and related text).

Therefore, it would have been obvious to combine Lubbers with Bride for the benefit of creating a system/method of resizing virtual disks to obtain the invention as specified in claim 23.

15. As per claim 24 The apparatus of claim 23, further comprising: a host device adapted to send a request to the management module to expand the mirrored virtual disks **[Lubbers discloses the capacity requirements are sent from host storage device to controllers 105 and source and destination virtual disks are resized accordingly (col. 4, lines 44-67; col. 5, line 27-col. 6, line 5)]**.

16. **Claims 3 and 17-18** are rejected under 35 U.S.C. 103(a) as being unpatentable over Lubbers et al. (US 6,880,052) in view of Bridge (US 6,530,035) as applied to claim 1 above, and further in view of Cabrera et al. (US 6,629,202).

17. As per claim 3, the combination of Lubbers and Bridge disclsoes The program storage device of claim 2, but does not disclose expressly wherein the specifying a size for the virtual disk and mapping the size of the virtual disk is performed by an operating system.

Cabrera discloses specifying a size for the virtual disk and mapping the size of the virtual disk is performed by an operating system as **[logical volumes are mapped and resized under the control of the operating system (col. 8, lines 59-67; col. 10, lines 4-17; col. 11, line 50-col. 12, line 33)]**.

Lubbers, Bridge and Cabrera are analogous art because they are from the same field of endeavor of computer memory access and control.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify the combined system of Lubbers and Bridge to have the operating system perform the specifying a size for the virtual disk and mapping the size of the virtual disk as taught by Cabrera, since Cabrera discloses this would provide dynamic volume resizing without system disruption.

Therefore, it would have been obvious to combine Lubbers with Bridge and Cabrera for the benefit of creating a system/method to obtain the invention as specified in claim 3.

18. As per claim 17 The program storage device of claim 1, further comprising: providing by the source virtual disk continuous availability for normal disk access operations between the step

of receiving a request and the step of reporting the new size of the source virtual disk **[Lubbers discloses the host can continuously write to source (col. 12, line 38-col. 13, line 15)]**; but Lubbers is not explicitly that this continuous access occurs during resizing. However, Cabrera discloses **[logical volumes and their plex are dynamically mapped and resized under the control of the operating system without system disruption (col. 8, lines 59-67; col. 10, lines 4-17; col. 11, line 50-col. 12, line 33)]**.

Lubbers, Bridge and Cabrera are analogous art because they are from the same field of endeavor of computer memory access and control.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify the combined system of Lubbers and Bridge to have logical volumes and their plex are dynamically mapped and resized under the control of the operating system without system disruption as taught by Cabrera discloses since this would provide faster and continuous access while configuring/reconfiguring logical volumes.

Therefore, it would have been obvious to combine Lubbers with Bridge and Cabrera for the benefit of creating a system/method to obtain the invention as specified in claim 17.

19. As per claim 18 The program storage device of claim 17, the method further comprising: providing by the at least one destination virtual disk continuous mirroring of the source virtual disk between the step of receiving a request and the step of reporting the new storage size of the source virtual disk **[Lubbers discloses each time data is written to source, a copy operation is scheduled to destination, wherein these copy operations can be scheduled as needed and explains ongoing operations of copying data from the source to the destination can be**

performed (col. 12, line 57-col. 13, line 15). Cabrera further discloses data is continuously mirrored by first plex component (col. 11, line 50-col. 12, line 33)].

20. **Claims 4, 7, 10, 13 and 16** are rejected under 35 U.S.C. 103(a) as being unpatentable over Lubbers et al. (US 6,880,052) in view of Bridge (US 6,530,035) and DeKoning (US 6,275,898).

21. As per claim 4. (currently amended) Lubbers discloses A program storage device readable by a computer embodying in a tangible medium one or more programs of instructions executable by the computer to perform a method for dynamically resizing mirrored virtual disks in a RAID storage system, the method comprising: **[resizing virtual disks or logical units (LUNs) in an automated fashion in a copy set or replication environment having source and destination LUNs wherein each LUN has a RAID 0-5 data protection (col. 4, lines 44-67; col. 5, lines 59-62)]**

receiving a request to dynamically shrink mirrored virtual disks in the RAID storage system, which include the source virtual disk and at least one destination virtual disk; and resizing the at least one destination virtual disk **[Lubbers discloses resizing members of a copy set dynamically wherein any change made to one LUN member of a copy set is automatically propagated to the other members (col. 4, lines 44-67; col. 6, lines 5-37); wherein Applicant should note that the ability to resize inherently includes the ability of shrinking (such as shrinking taught by Bridge and DeKoning in the following discussion) the size of any of the members of the copy set]**

changing the reported size of the virtual disks and making the virtual disks available for operation; **[Lubbers discloses resizing virtual disks or logical units (LUNs) in an automated fashion in a copy set or replication environment having source and destination LUNs wherein each LUN has a RAID 0-5 data protection (col. 4, lines 44-67; col. 5, lines 59-62), and explains "hosts… access physical storage capacity by addressing read and write operations to specified LUNs… storage controller… manage the tasks of allocating… resizing LUNs, and other functions that maintain integrity and availability of the data" (col. 5, line 51-col. 6, line 5); thus, the reported size of the virtual disks is changed an the disks are available to hosts as LUNs]**.

Lubbers does not expressly disclose after making the virtual disks available for operation, manipulating RAIDS in the RAID storage system assigned to the mirrored virtual disks prior to resizing the mirrored virtual disks, wherein the step of manipulating further comprises specifying a size of a virtual disk and mapping the size of the virtual disk directly to all components of a mirror set, detaching any RAIDs that extend beyond the specified size of the virtual disk, and truncating RAIDs to free up any excess physical segments back into the RAID storage system.

Bridge discloses changing the reported size of the virtual disks and making the virtual disk available for operation; as **[shrinking logical volumes by removing extents and updating directory (col. 20, lines 1-33)]** and after making the virtual disks available for operation, manipulating physical storage in order to resize the virtual disks by deallocating necessary storage in order to reach the desired shrunk size **[wherein when the logical volume shrunk, the size of the logical volume is first updated in the volume directory (thus made available), then each extent set is deallocated until the logical volume has shrunk to the correct size**

(col. 20, lines 1-33; also refer to expanding in col. 16, line 32- col. 17, line 4) wherein the added or removed extents may be mirrored (col. 17, line 5-col. 18, line 58)].

Lubbers and Bridge are analogous art because they are from the same field of endeavor of computer memory access and control.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify the system of Lubbers which provides source and destination virtual disks in a copy set and resizes these virtual disks in an automatic fashion wherein any changes to a source virtual disk are propagated to the destination virtual disk and further explicitly perform changes of size of the copy set of source and destination virtual disks of Lubbers and discloses changing the reported size of the virtual disks and making the virtual disk available for operation; and after making the virtual disks available for operation, manipulating physical storage in order to resize the virtual disks by deallocating necessary storage in order to reach the desired shrunk size as taught by Bridge, since Bridge discloses doing so would provide the advantage of dynamically accommodating to system requirement changes in a mirrored system configuration (col. 3, line 45-col. 4, line 59; fig. 9 and related text); however, the combination of Lubbers and Bridge does not expressly disclose manipulating RAIDS in the RAID storage system assigned to the mirrored virtual disks prior to resizing the mirrored virtual disks, wherein the step of manipulating further comprises specifying a size of a virtual disk and mapping the size of the virtual disk directly to all components of a mirror set, detaching any RAIDs that extend beyond the specified size of the virtual disk, and truncating RAIDs to free up any excess physical segments back into the RAID storage system.

DeKoning discloses manipulating RAIDS in the RAID storage system assigned to the mirrored virtual disks prior to resizing the mirrored virtual disks, wherein the step of manipulating further comprises specifying a size of a virtual disk and mapping the size of the virtual disk directly to all components of a mirror set, detaching any RAIDs that extend beyond the specified size of the virtual disk, and truncating RAIDs to free up any excess physical segments back into the RAID storage system; as **[a LUN may be broken up into a plurality of partitions wherein "each partition retains its own configuration and mapping information. Each partition is therefore managed essentially as though a separate RAID LUN" (col. 4, lines 23-26) wherein each partition may grow or shrink in accordance to its capacity requirements (col. 7, lines 46-48) wherein when a partition is to shrink or be demoted, its RAID level configuration is manipulated to change from a RAID level requiring more space to one requiring less space (col. 7, lines 10-48) and any RAIDs or unused RAID space is detached and pooled in an unused space pool (col. 7, lines 29-48) and RAIDs are truncated so that the available partition space is changed from 20 MB in size to for example, 10 MB (col. 10, line 25-col. 11, lines 7) thus the unused space is freed up into the RAID system to the pool of unused space (col. 7, lines 29-48; col. 11, lines 3-7)]**.

Lubbers, Bridge and DeKoning are analogous art because they are from the same field of endeavor of computer memory access and control.

At the time of the invention, it would have been obvious to one having ordinary skill in the art to modify the combined system/method of Lubbers and Bridge wherein mirrored virtual disks are resized and any changes to one member of a copy set consisting of a source and destination LUNs are automatically propagated to the other member to further perform said

resizing in a manner such as that taught by DeKoning wherein RAIDs are manipulated prior to resizing a LUN and RAIDs are detached and truncated to free up space in the LUN since DeKoning discloses such approach would ensure **[provision of simpler techniques in manipulation of a LUNs and simplified dynamic adjustment of configuration of a RAID storage system to adapt to desired performance and utilization goals (col. 3, lines 52-55; col. 4, lines 57-61)]**.

Therefore, it would have been obvious to combine Lubbers with Bride for the benefit of creating a system/method of resizing virtual disks to obtain the invention as specified in claim 4.

22. As per claim 7. (previously presented) A program storage device readable by a computer embodying in a tangible medium one or more programs of instructions executable by the computer to perform a method for dynamically shrinking mirrored virtual disks in a RAID storage system, the method comprising: specifying a size of a virtual disk and mapping the size of the virtual disk directly to all components of a mirror set; detaching any RAIDs that extend beyond the specified size of the virtual disk; and truncating RAIDs to free up any excess physical segments back into the RAID storage system **[The rationale in the rejection to claim 4 is herein incorporated]**.

23. As per claim 10. (previously presented) An apparatus for dynamically resizing mirrored virtual disks in a RAID storage system, comprising: a storage system interface for providing access to a storage system; host side interface for communicating with host devices; and a processor, coupled to the host side interface and the storage system interface, the processor being configured for receiving a request to resize mirrored virtual disks in a RAID storage system to a new size, changing reported size of the mirrored virtual disks to the new size, providing resized

mirrored virtual disks for operaion, manipulating RAIDs in the RAID storage system assigned to the mirrored virtual disks prior to resizing the mirrored virtual disks, mapping the size of the virtual disk directly to all components of a mirror set, detaching any RAIDs that extend beyond the specified size of the virtual disk, and truncating RAIDs to free up any excess physical segments back into the RAID storage system, **[The rationale in the rejection to claim 4 is herein incorporated]**; further requiring:

a storage system interface for {*interpreted as intended use, see MPEP 2106 II-C*} providing access to a storage system; host side interface for {*interpreted as intended use, see MPEP 2106 II-C*}communicating with host devices; **[Lubbers discloses storage controllers 105 virtualize physical storage into logical units LUNs and hosts 102 access storage by addressing LUNs (col. 5, lines 51-67; fig. 1 and related text) via for example, FC switch (301) (fig. 3 and related text)]** and a processor, coupled to the host side interface and the storage system interface, the processor being configured for {*interpreted as intended use, see MPEP 2106 II-C*}receiving a request to dynamically resize mirrored virtual disks in a RAID storage system **[Lubbers discloses storage controllers 105 virtualize each LUN, including resizing of LUNs (col. 5, line 51-col. 6, line 37) and are coupled to hosts 102 computers (col. 5, lines 27-62)]**.

24. As per claim 13. (previously presented) A storage area network, comprising: a plurality of hosts; at least one access device, coupled to the plurality of hosts, for managing data input/output operations; and a storage platform, for providing networked storage to the at least one access device, the storage platform including a management device for dynamically resizing mirrored virtual disks in a RAID storage system, the management device further comprising: a

storage system interface for providing access to a storage system; host side interface for communicating with host devices; and a processor, coupled to the host side interface and the storage system interface, the processor being configured for receiving a request to resize mirrored virtual disks in a RAID storage system to a new size, changing reported size of the mirrored virtual disks to the new size, providing resized virtual disks for operation, manipulating RAIDs in the RAID storage system assigned to the mirrored virtual disks mapping the size of the virtual disk directly to all components of a mirror set, detaching any RAIDs that extend beyond the specified size of the virtual disk and truncating RAIDs to free up any excess physical segments back into the RAID storage system **[The rationale in the rejection to claim 4 is herein incorporated]**; further requiring:

A storage area network, comprising: **[Lubbers discloses storage area network (SAN) (fig. 1 and related text)]** a plurality of hosts; **[hosts 102 (fig. 1 and related text)]** at least one access device, coupled to the plurality of hosts, for managing data input/output operations; **[host computers which may be any kind of computer or processor performing input/output of data from storage devices on SAN (col. 5, lines 27-50)]** and a storage platform, for providing networked storage to the at least one access device, the storage platform including a management device for dynamically resizing mirrored virtual disks in a RAID storage system, the management device further comprising: a storage system interface for providing access to a storage system; **[Lubbers discloses SAN including physical storage virtualized by controllers 105 into logical units LUNs, which also resize LUNs (col. 5, line 51-col. 6, lines 37)]** host side interface for communicating with host devices; **[Lubbers discloses storage controllers 105 virtualize physical storage into logical units LUNs and hosts 102 access storage by**

addressing LUNs (col. 5, lines 51-67; fig. 1 and related text) via for example, FC switch (301) (fig. 3 and related text)] and a processor, coupled to the host side interface and the storage system interface, the processor being configured for receiving a request to dynamically resize mirrored virtual disks in a RAID storage system **[Lubbers discloses storage controllers 105 virtualize each LUN, including resizing of LUNs (col. 5, line 51-col. 6, line 37) and are coupled to hosts 102 computers (col. 5, lines 27-62)]**.

25. As per claim 16. (previously presented) An apparatus for dynamically resizing mirrored virtual disks in a RAID storage system, comprising: first means for providing an interface to a storage system; second means for providing communication with host devices; and means, coupled to the host side interface and the storage system interface, for receiving a request to dynamically resize mirrored virtual disks in a RAID storage system, manipulating RAIDs in the RAID storage system assigned to the mirrored virtual disks, wherein the means for manipulating further comprises means for specifying a size of a virtual disk and mapping the size of the virtual disk directly to all components of a mirror set, detaching any RAIDs that extend beyond the specified size of the virtual disk and truncating RAIDs to free up any excess physical segments back into the RAID storage system, and before the step of manipulating RAIDs, resizing the mirrored virtual disks, and providing the resized mirrored virtual disks for operation **[The rationale in the rejection to claims 4, 7 and 13 is herein incorporated]**.

26. **Claim 5** is rejected under 35 U.S.C. 103(a) as being unpatentable over Lubbers et al. (US 6,880,052) in view of Bridge (US 6,530,035) and DeKoning (US 6,275,898) as applied to claim 5 above, and further in view of Cabrera et al. (US 6,629,202).

27. As per claim 5. (original) The combination of Lubbers, Bridge and DeKoning discloses The program storage device of claim 4 but does not expressly disclose wherein the specifying a size for the virtual disk and mapping the size of the virtual disk is performed by an operating system.

Cabrera discloses specifying a size for the virtual disk and mapping the size of the virtual disk is performed by an operating system as **[logical volumes are mapped and resized under the control of the operating system (col. 8, lines 59-67; col. 10, lines 4-17; col. 11, line 50-col. 12, line 33)]**.

Lubbers, Bridge, DeKoning and Cabrera are analogous art because they are from the same field of endeavor of computer memory access and control.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify the combined system of Lubbers, Bridge and DeKoning to have the operating system perform the specifying a size for the virtual disk and mapping the size of the virtual disk as taught by Cabrera, since Cabrera discloses this would provide dynamic volume resizing without system disruption.

Therefore, it would have been obvious to combine Lubbers with Bridge, DeKoning and Cabrera for the benefit of creating a system/method to obtain the invention as specified in claim 5.

ACKNOWLEDGMENT OF ISSUES RAISED BY THE APPLICANT

Response to Amendment

28. Applicant's arguments filed on 2/12/2010 have been considered but they are not deemed persuasive.

29. As required by **M.P.E.P. § 707.07(f)**, a response to these arguments appears below.

ARGUMENTS CONCERNING PRIOR ART REJECTIONS

30. Claims must be given the broadest reasonable interpretation during examination and limitations appearing in the specification but not recited in the claim are not read into the claim (See M.P.E.P. 2111 [R-1]).

Claim 1

31. Regarding Applicant's remarks referring to the combination of Lubbers and Bridge not teaching resizing propagated synchronously to second virtual disk; it is noted that these features are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

32. Applicant argues the combination of Lubbers and Bridge does not disclose "increasing respective sizes of each of the at least one destination virtual disk before reporting a new storage size of the source virtual disk; and reporting the new size of the source virtual disk" as "the order that Lubbers teaches. First the LUN is resized. Then the resizing is automatically propagated to other members of the copy set… is radically different from what Applicant does... you can follow Lubbers and use Bridge's approach to expand, and still wind up with an automated

approach that is asynchronous. In Applicant's approach, the space is made available for both virtual disks before the new size is reported... and Bridge deals with resizing individual logical volumes, and does not specify the order of how a pair of mirroring disks should be handled."

In response, these arguments have been fully considered, but they are not deemed persuasive.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

First, the Examiner would like to point out that there is no requirement or limitation in claim 1 dictating that there be synchronous approach to the increase in size, but simply that a pair of mirror disks be resized or that their size is increased before the size is reported.

Accordingly, Lubbers clearly teaches resizing of a copy set or pair of virtual disks **[Lubbers discloses "a copy set" is a set of member virtual disks where each member virtual disk is a replica of the others" (col. 8, line 57-col. 9, line 8) wherein a LUN may be resized and the resizing is automatically propagated to other members of the copy set (col. 4, lines 44-67; col. 6, lines 5-37)]**, but does not expressly disclose when the new sizes are reported. Thus, the problem to be solved is to determine when to report the new sizes of an already resized pair of mirror disks. Regarding this limitation, Bridge discloses **[expanding logical volumes by adding extents wherein when the logical volume is configured to a new size, the new size is later reported in logical volume directory; thus allowing I/O operations on the logical volume, refer to steps 3 and 4 (col. 16, line 32- col. 17, line 4) wherein the added or removed**

extents may be mirrored (col. 17, line 5-col. 18, line 58) and when a mirrored configuration is used, Bridge discloses step 1, wherein a primary extent is allocated; step 2, where extents are allocated on the destination, secondary or mirror disk; and later, in step 4, Bridge discloses, "once all primary and secondary extents have been allocated, update pointers in either the logical volume directory or in pointer extents to point to new extents… The appropriate allocation tables should also be updated to reflect the allocations" (col. 17, lines 22-52)]; thus, providing a solution and suggestion as to when to report the new size of logical volumes, including logical volume pairs of mirrors, which are first modified, and later, their directory is updated or reported to allow I/O operations to the newly expanded or modified area.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to modify the system of Lubbers which provides source and destination virtual disks in a copy set and resizes these virtual disks in an automatic fashion wherein any changes to a source virtual disk are propagated to the destination virtual disk and further explicitly expand the size or perform changes of size of the copy set of source and destination virtual disks of Lubbers and later reporting the size of the copy set or source and destination virtual disks in the same manner that Bridge first resizes a logical unit (*including a mirrored configuration, wherein mirror partners are first modified and later the directory is updated*), and later reports the changes to the logical unit by updating directory tables in order to allow I/O access to the virtual disks, since Bridge discloses this provides the advantage of dynamically accommodating to system requirement changes in a mirrored system configuration (col. 3, line 45-col. 4, line 59; fig. 9 and related text).

Claim 17

33. With respect to the limitation "providing by the source virtual disk continuous availability for normal disk access operations between the step of receiving a request and the step of reporting the new storage size of the source virtual disk"; Applicant argues Lubbers does not apply because Lubbers teaching "the host can continuously write to source… pertains to creation of a new destination virtual disk… and not to resizing of a mirrored pair or set… The process which Figure 6 describes includes quiescing the source... and copying data in background...this is anything but continuous availability" and Cabrera "does not disclose the relative timing or resizing and reporting in a mirrored pair…".

In response, these arguments have been fully considered, but are not deemed persuasive.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

In view of the following discussion, Examiner would like to emphasize the following:

Sources of rationale supporting a rejection under 35 U.S.C. 103 may be in a reference, or reasoned from common knowledge in the art, scientific principles, art recognized equivalents, or legal precedent. The CCPA has held that "in considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the inferences

which one skilled in the art would reasonably be expected to draw therefrom." In re Preda, 401 F.2d 825, 826, 159 USPQ 342, 344 (CCPA 1968); MPEP 2144.01.

In determining obviousness under 35 U.S.C. 103 in view of the Supreme Court decision in KSR International Co. v. Teleflex Inc., the Supreme Court stated that: "If a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill".

Still further, the Court states that "the focus when making a determination of obviousness should be on what a person of ordinary skill in the pertinent art would have known at the time of the invention…and this is regardless of whether the source of that knowledge and ability was documentary prior art, general knowledge in the art, or common sense".

34. With respect to the limitation "providing by the source virtual disk continuous availability for normal disk access operations between the step of receiving a request and the step of reporting the new storage size of the source virtual disk"; Applicant argues Lubbers does not apply because Lubbers teaching "the host can continuously write to source… pertains to creation of a new destination virtual disk… and not to resizing of a mirrored pair or set… The process which Figure 6 describes includes quiescing the source... and copying data in background...this is anything but continuous availability" and Cabrera "does not disclose the relative timing or resizing and reporting in a mirrored pair…".

In this case, claim 17 has been rejected as being unpatentable for being obvious over Lubbers in view of Bridge and further in view of Cabrera. There is no limitation in claim 17

referring to the relative timing or resizing and reporting in a mirrored pair. The combination of Lubbers and Bridge has been relied upon for disclosing the relative timing or resizing and reporting in a mirrored pair (See discussion above regarding arguments with respect to claim 1).

The combination of Lubbers, Bridge and Cabrera discloses "providing by the source virtual disk continuous availability for normal disk access operations between the step of receiving a request and the step of reporting the new storage size of the source virtual disk"; as **[Lubbers discloses the host can continuously write to source (col. 12, line 38-col. 13, line 15)]**; but Lubbers is not explicitly that this continuous access occurs during resizing. However, Cabrera discloses **[logical volumes and their plex are dynamically mapped and resized under the control of the operating system without system disruption (col. 8, lines 59-67; col. 10, lines 4-17; col. 11, line 50-col. 12, line 33)]**; thus, disclosing resizing (which would include between the step of receiving a request and the step of reporting the new storage size of the source virtual disk) of logical volume mirror pairs while providing continuous access or no disruption. Therefore, it would have been obvious to one of ordinary skill in the art to modify the combined system of Lubbers and Bridge to have logical volumes and their plex are dynamically mapped and resized under the control of the operating system without system disruption as taught by Cabrera discloses since this would provide faster and continuous access while configuring/reconfiguring logical volumes.

Claim 4

35. Applicant argues "the downsizing must be reported in a specific order relative to the actual shrinking of the available storage for the virtual disks... Bridge describes a process for

downloading (*it is believed this is a typographical error and that this term should be "downsizing"*) individual logical volumes. Lubbers is silent about the timing of changing the reported size of the virtual disk and shrinking individual volumes in a copy set."

In response, these arguments have been fully considered, but are not deemed persuasive.

Regarding the order argued by Applicant, claim 4, as amended, requires "changing the reported size of the virtual disks and making the virtual disks available for operation; after making the virtual disks available for operation, manipulating RAIDs" which is disclosed by the combination of Lubbers, Bridge and DeKoning as Lubbers discloses changing the reported size of the virtual disks and making the virtual disks available for operation; **[Lubbers discloses resizing virtual disks or logical units (LUNs) in an automated fashion in a copy set or replication environment having source and destination LUNs wherein each LUN has a RAID 0-5 data protection (col. 4, lines 44-67; col. 5, lines 59-62), and explains "hosts… access physical storage capacity by addressing read and write operations to specified LUNs… storage controller… manage the tasks of allocating… resizing LUNs, and other functions that maintain integrity and availability of the data" (col. 5, line 51-col. 6, line 5); thus, the reported size of the virtual disks is changed an the disks are available to hosts as LUNs]**; note that there is no specific order associate with this portion of the limitation.

Lubbers does not expressly disclose after making the virtual disks available for operation, manipulating RAIDS in the RAID storage system assigned to the mirrored virtual disks prior to resizing the mirrored virtual disks, wherein the step of manipulating further comprises specifying a size of a virtual disk and mapping the size of the virtual disk directly to all components of a

mirror set, detaching any RAIDs that extend beyond the specified size of the virtual disk, and truncating RAIDs to free up any excess physical segments back into the RAID storage system.

Bridge discloses changing the reported size of the virtual disks and making the virtual disk available for operation; as **[shrinking logical volumes by removing extents and updating directory (col. 20, lines 1-33)]** and after making the virtual disks available for operation, manipulating physical storage in order to resize the virtual disks by deallocating necessary storage in order to reach the desired shrunk size **[wherein when the logical volume shrunk, the size of the logical volume is first updated in the volume directory (thus made available), then each extent set is deallocated until the logical volume has shrunk to the correct size (col. 20, lines 1-33; also refer to expanding in col. 16, line 32- col. 17, line 4) wherein the added or removed extents may be mirrored (col. 17, line 5-col. 18, line 58)]**.

At the time of the invention it would have been obvious to modify the resizing of Lubbers to specifically, after making the virtual disks available for operation, manipulating physical storage in order to resize the virtual disks by deallocating necessary storage in order to reach the desired shrunk size as taught by Bridge, since Bridge discloses doing so would provide the advantage of dynamically accommodating to system requirement changes in a mirrored system configuration (col. 3, line 45-col. 4, line 59; fig. 9 and related text).

36. Regarding all other Claims not specifically traversed above and whose rejections were upheld, the Applicant contends that the listed claims are allowable by virtue of their dependence on other allowable claims. As this dependence is the sole rationale put forth for the allowability of said dependent claims, the Applicant is directed to the Examiner's remarks above.

Additionally, any other arguments the Applicant made that were not specifically addressed in this Office Action appeared to directly rely on an argument presented elsewhere in the Applicant's response that was traversed, rendered moot or found persuasive above.

37. All arguments by the applicant are believed to be covered in the body of the office action; thus, this action constitutes a complete response to the issues raised in the remarks dated 2/12/2010.

CLOSING COMMENTS

Conclusion

38. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

a. STATUS OF CLAIMS IN THE APPLICATION

39. The following is a summary of the treatment and status of all claims in the application as recommended by **M.P.E.P. 707.07(i)**:

a(1) CLAIMS REJECTED IN THE APPLICATION

40. Per the instant office action, claims 1-5, 7, 9-10, 13 and 17-24 have received an action on the merits and are subject of a final rejection.

b. DIRECTION OF FUTURE CORRESPONDENCES

41. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yaima Campos whose telephone number is (571) 272-1232. The examiner can normally be reached on Monday to Friday 8:30 AM to 5:00 PM.

42. If attempts to reach the above noted Examiner by telephone are unsuccessful, the Examiner's supervisor, Mr. Sanjiv Shah, can be reached at the following telephone number: Area Code (571) 272-4098.

The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

May 18, 2010

/Yaima Campos/
Examiner, Art Unit 2185

/Sanjiv Shah/

Supervisory Patent Examiner, Art Unit 2185